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BANTAM: A Cautionary Tale

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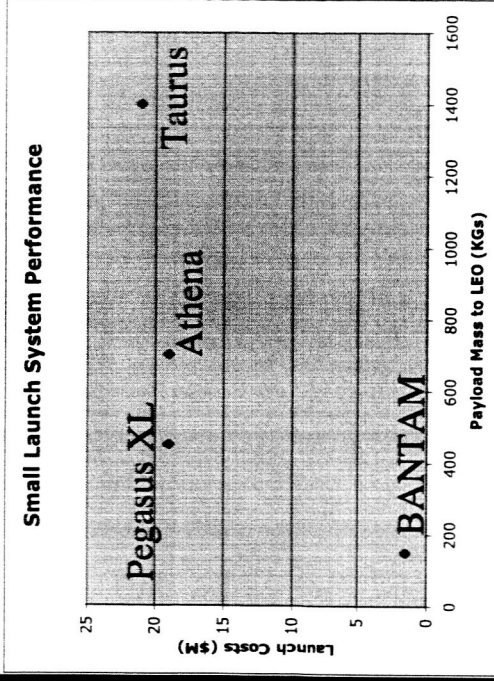
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Bantam Leads the Way in Small Low Cost Launch Systems

- In March, 1997 NASA issued NRA8-19 Cycle 2 for the Bantam System Technology Project
- 3 Investment Areas identified
 - Flight Demonstrators
 - Component Technologies
 - Upper Stage Technology Demonstrators (USFE)
- Flight Demonstrators
 - Open Architecture-all solutions welcomed
 - Two phase program
 - Phase 1-Initial Design & Business Planning
 - Phase 2- Flight Demonstration



- Advocacy primarily by “University class” payloads
- RLV Flight demonstration advocates

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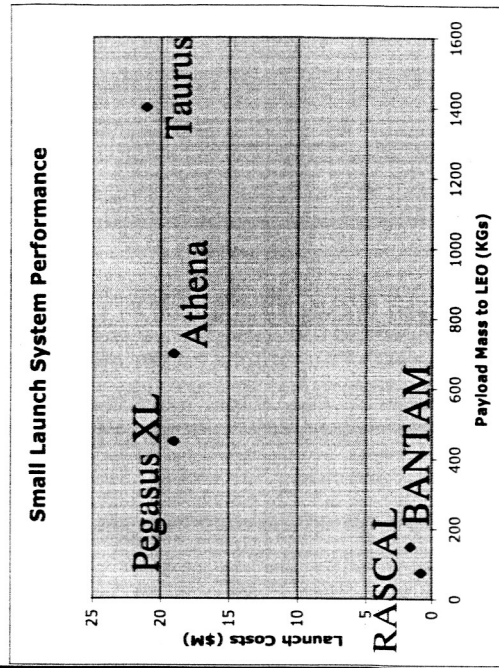
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RASCAL Goes Smaller

- In December, 2001 DARPA issued PS02-02 for Responsive Access, Small cargo, Affordable Launch (RASCAL)
- Hybrid Architecture Specified
 - Reusable “Zoom to launch” airplane
 - Expendable rocket vehicle (ERV)
- Three Phase program
 - 9 Month Study
 - System level design
 - Technology assessment
 - Life Cycle Cost (LCC) model
 - Risk Reduction phase
 - Detail design
 - Risk Reduction/Development
 - LCC refinement
 - Flight Demonstration



- Advocacy primarily “microsat” delivery
- Low Cost
- Responsiveness
- All azimuth

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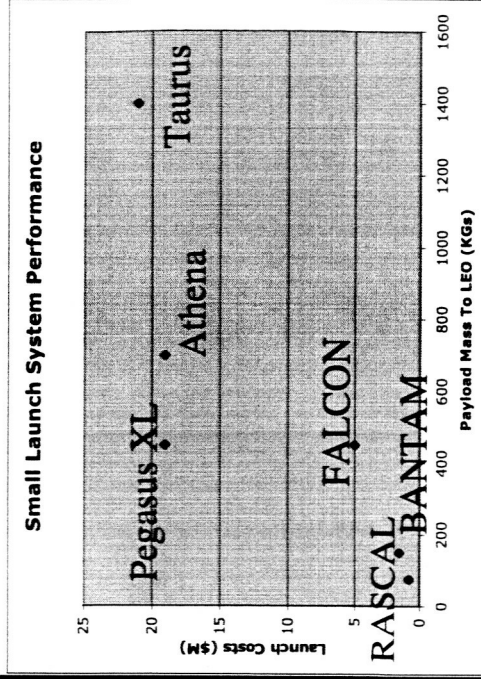
Falcon Goes Larger

- In July, 2003 DARPA issued BAA03-35 for the Force Application and Launch from CONUS Project

- Near term capabilities
 - Small Launch Vehicle (SLV)
 - Common Air Vehicle (CAV)
- Long term capabilities
 - Hypersonic Cruise Vehicle (HCV)

- SLV

- Deliver the CAV
- Deliver small satellites
- Two Phase Program
 - 6 month Study
 - 36 month flight demonstration



- Advocacy primarily weapons delivery
- Small satellite delivery
- Lower cost
- Higher responsiveness

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Today's Small Launcher Project Status

- Two DARPA Projects continue
 - RASCAL is in its risk reduction phase
 - Falcon is in its Flight Demonstration Phase

- NASA's Bantam Flight Demonstration Program was terminated in 1999
- A review of the key tenets of the Bantam Project may portend the future of the DARPA projects
 - Focus on Small Payloads
 - Commercially Viable Launch Service
 - Low Recurring Cost
 - Contribute to RLV Flight demonstrations

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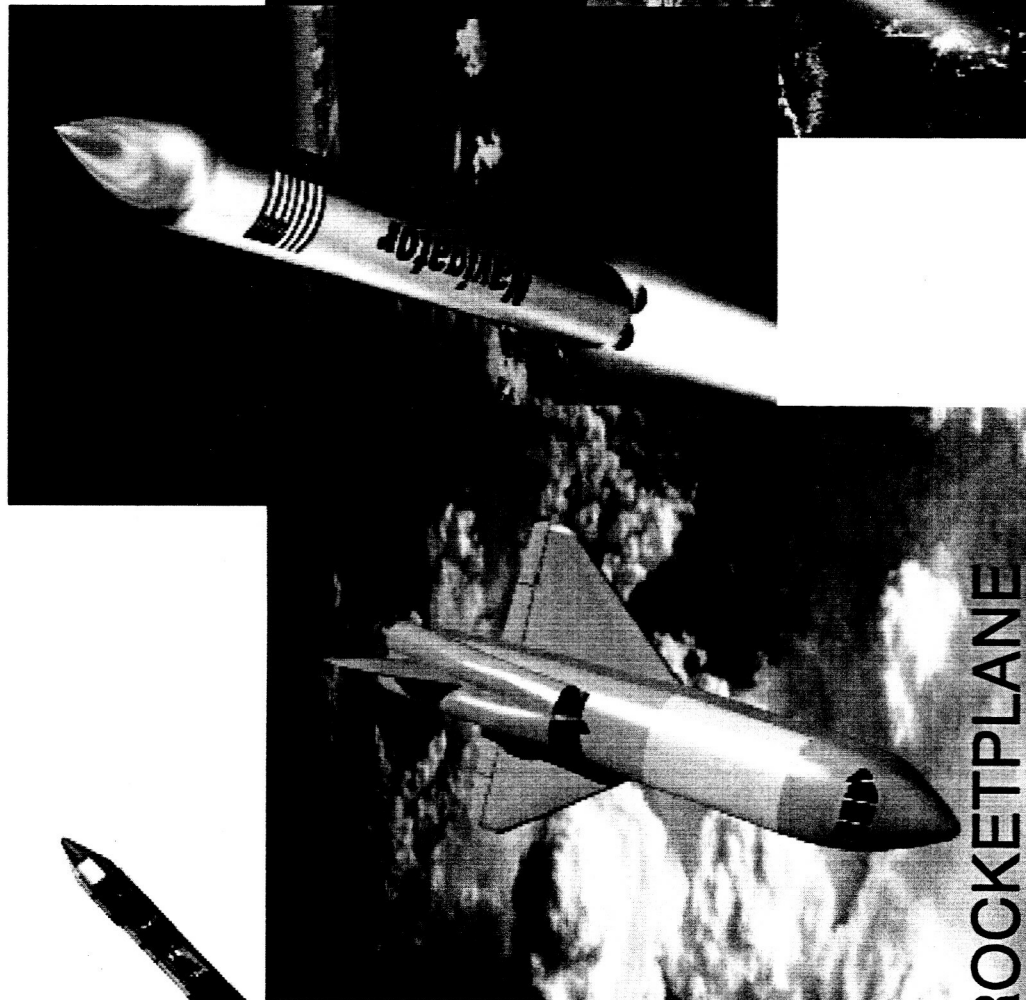


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Bantam Phase One Awards

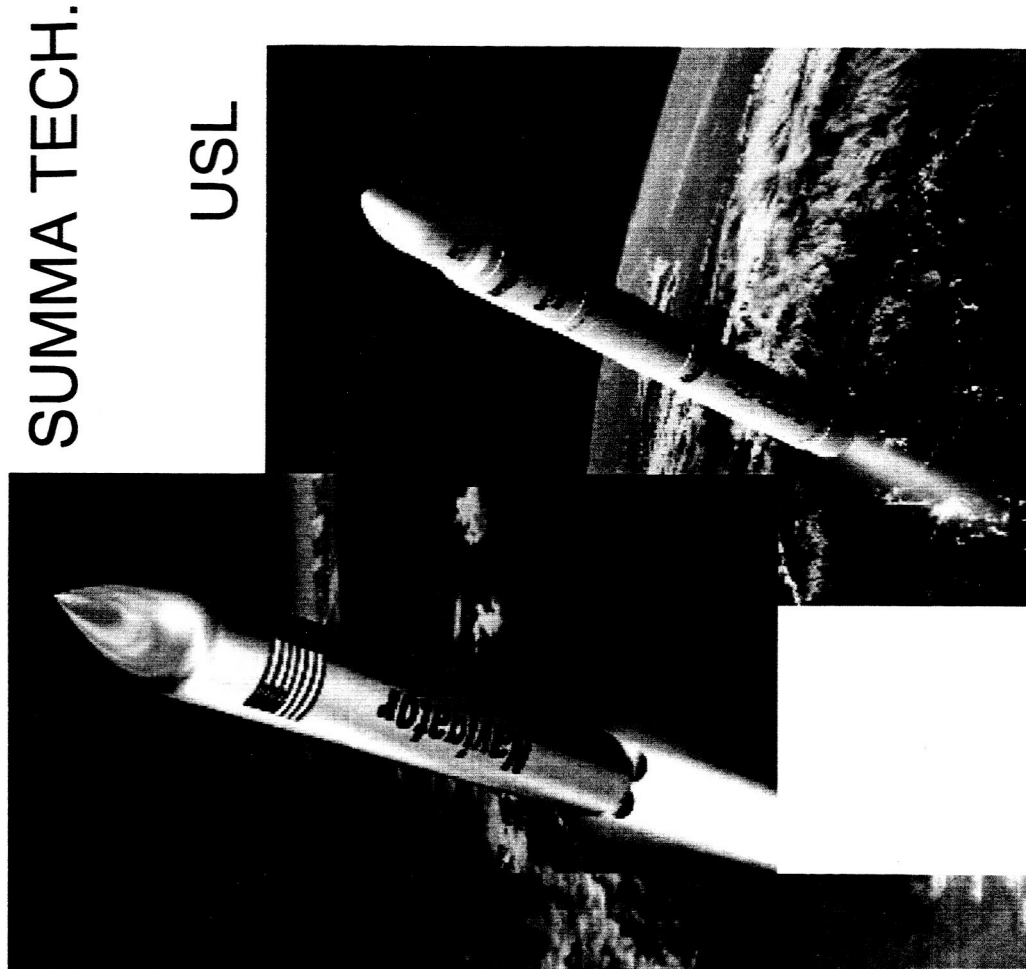


AEROJET



PIONEER ROCKETPLANE

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SUMMA TECH.

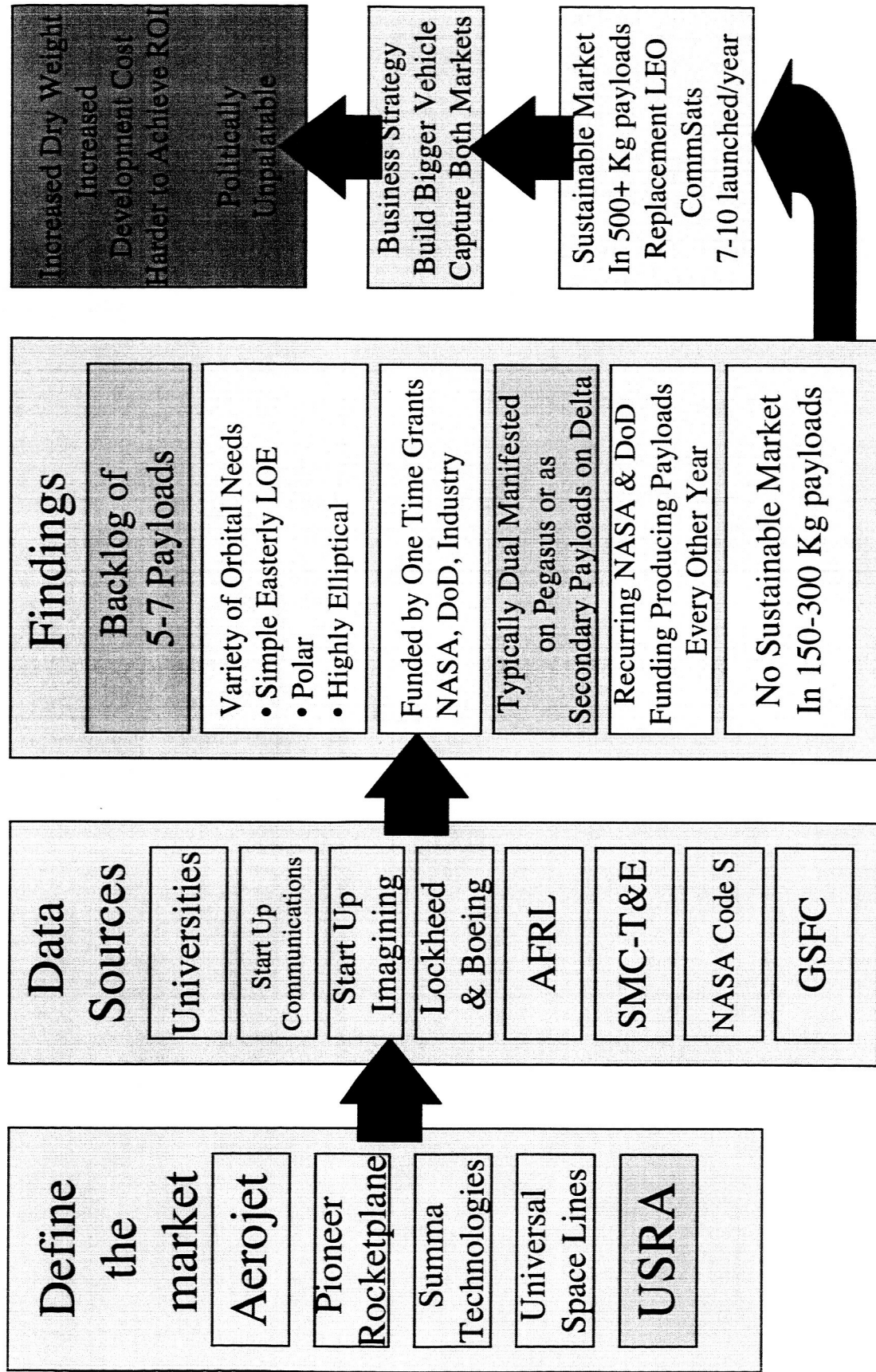
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Small Rockets Grow



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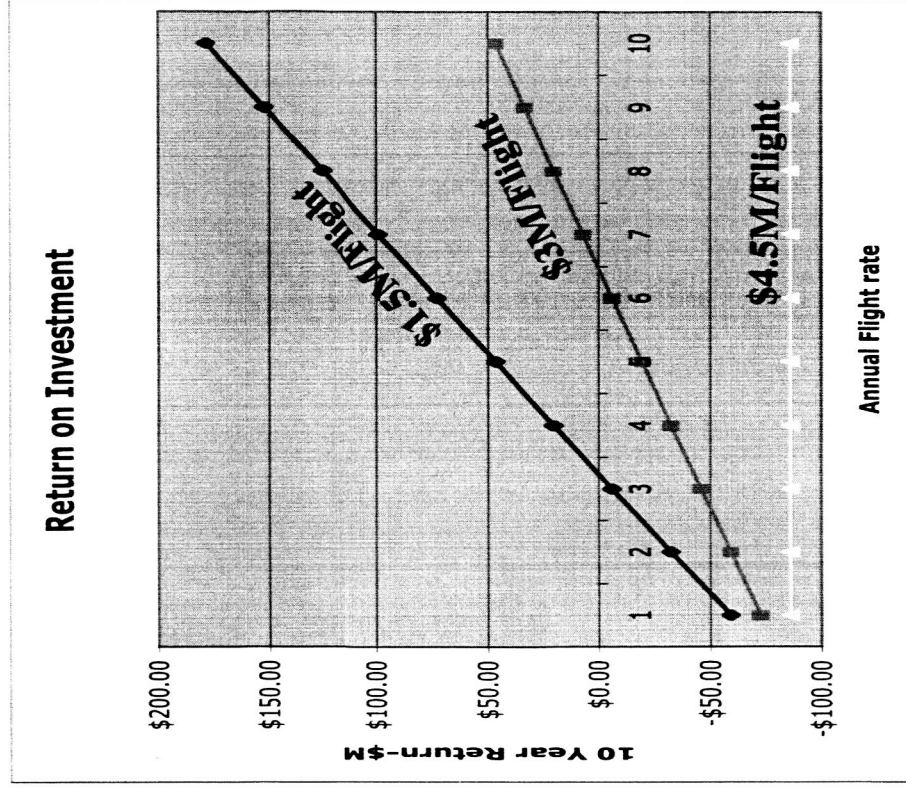


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Commercial Viability

- After start of operations launch system must achieve an acceptable Return on Investment (ROI)
- If Non Recurring development financed by government ROI must be 7% or greater annually
- ROI comes thru lower launch cost than alternative (Pegasus)
- At \$1.5M per flight 4 Flights per year required to achieve an acceptable ROI
- At \$3M per flight 7 Flights per year required to achieve an acceptable ROI
- Market survey only identified 1-2 launches of government payloads per year
- Acceptable ROI not achievable !!!

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Low Recurring Cost

- Hardware Costs
- Lowered by
 - Application of new technologies---\$\$\$
 - Designing for operations---\$
 - Competitive procurements---\$
 - High build rate---\$

- Other Operating Costs
 - Profit--10%
 - Insurance--10%
 - Range costs--\$200K
 - Operating Personnel Costs--\$200K

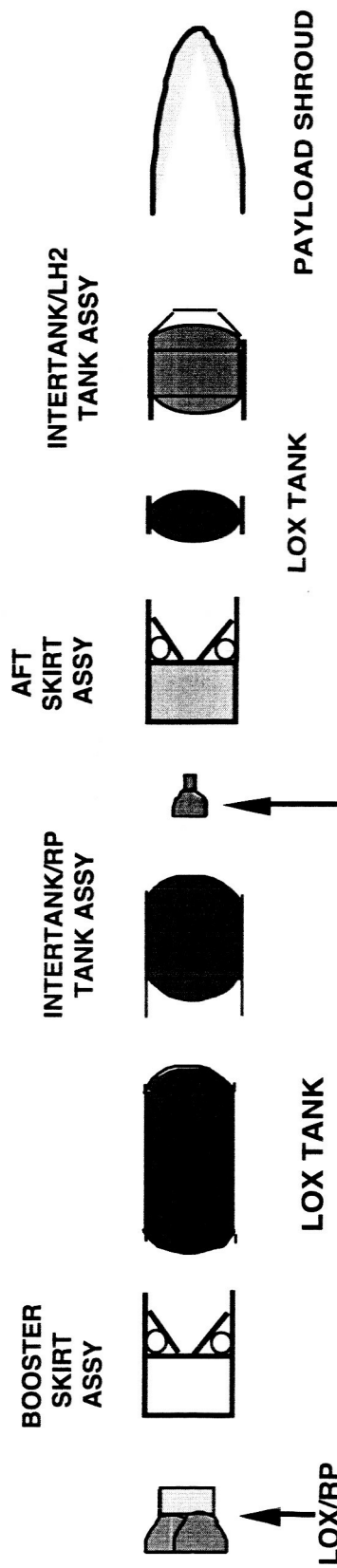
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Reference System Architecture Manufacturing Plan

VEHICLE ASSEMBLY

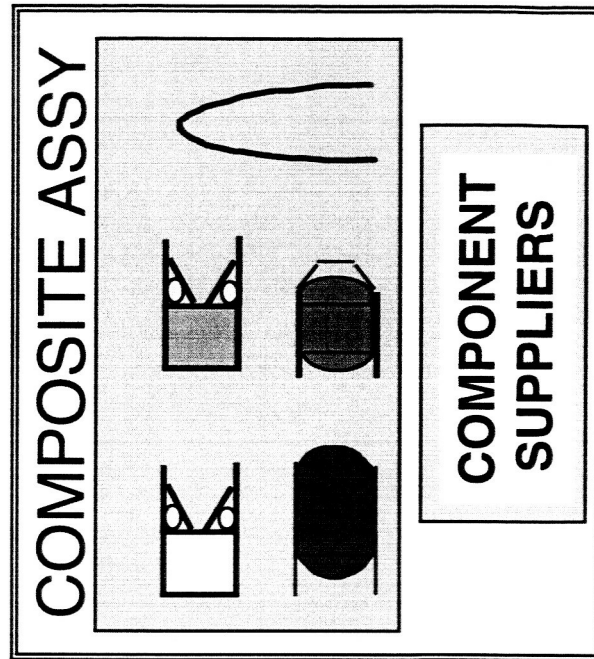
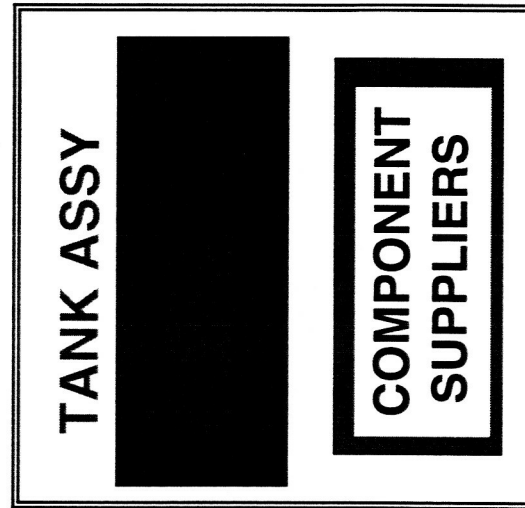
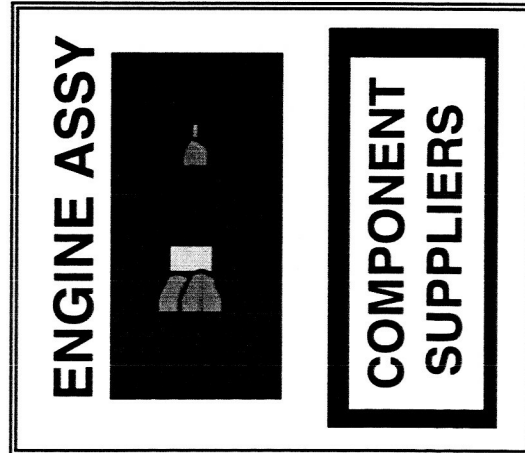


LOX/RP
ENGINE

LOX TANK

LOX TANK

PAYLOAD SHROUD



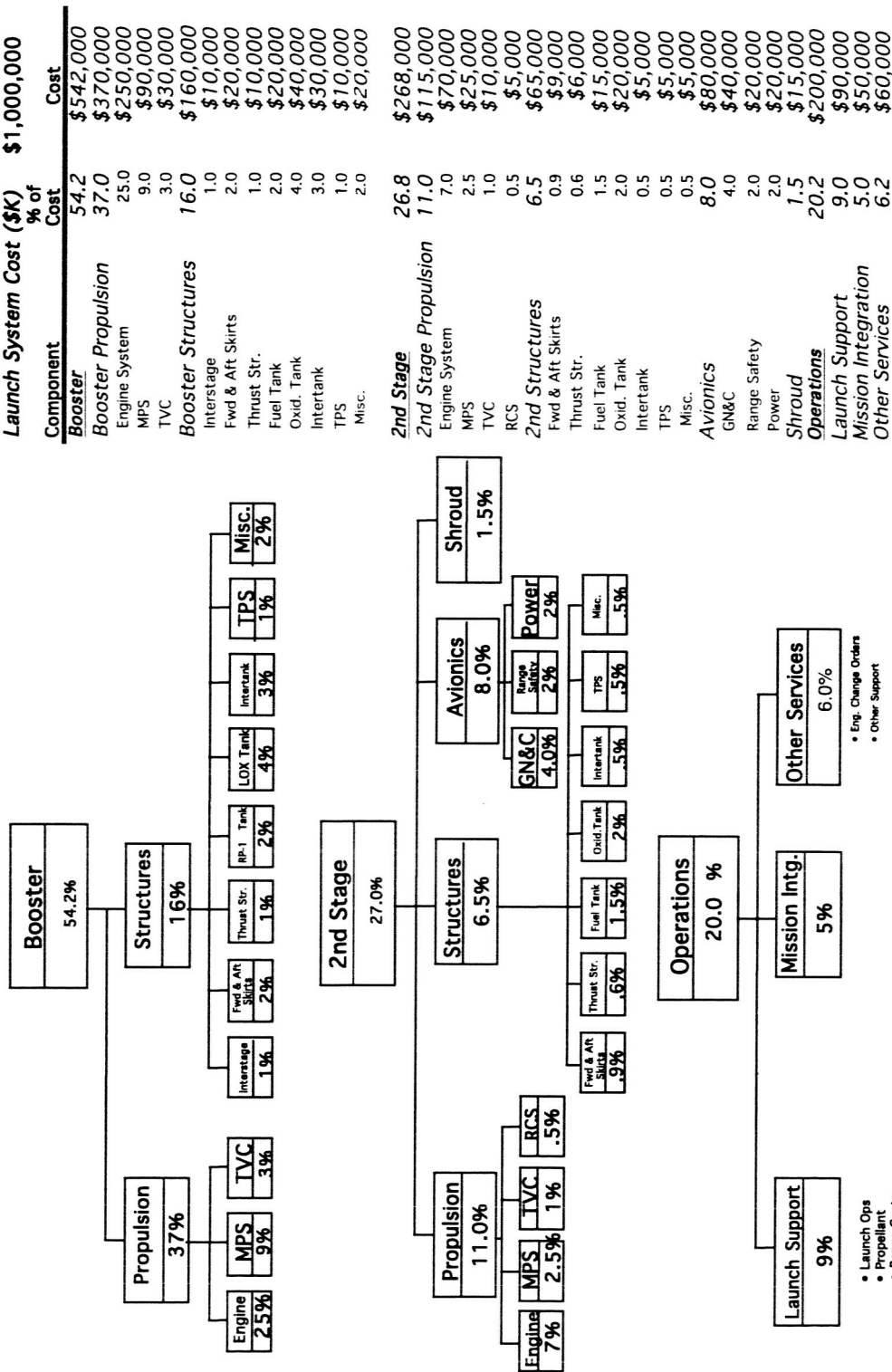
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Design to Cost Goals Were Established



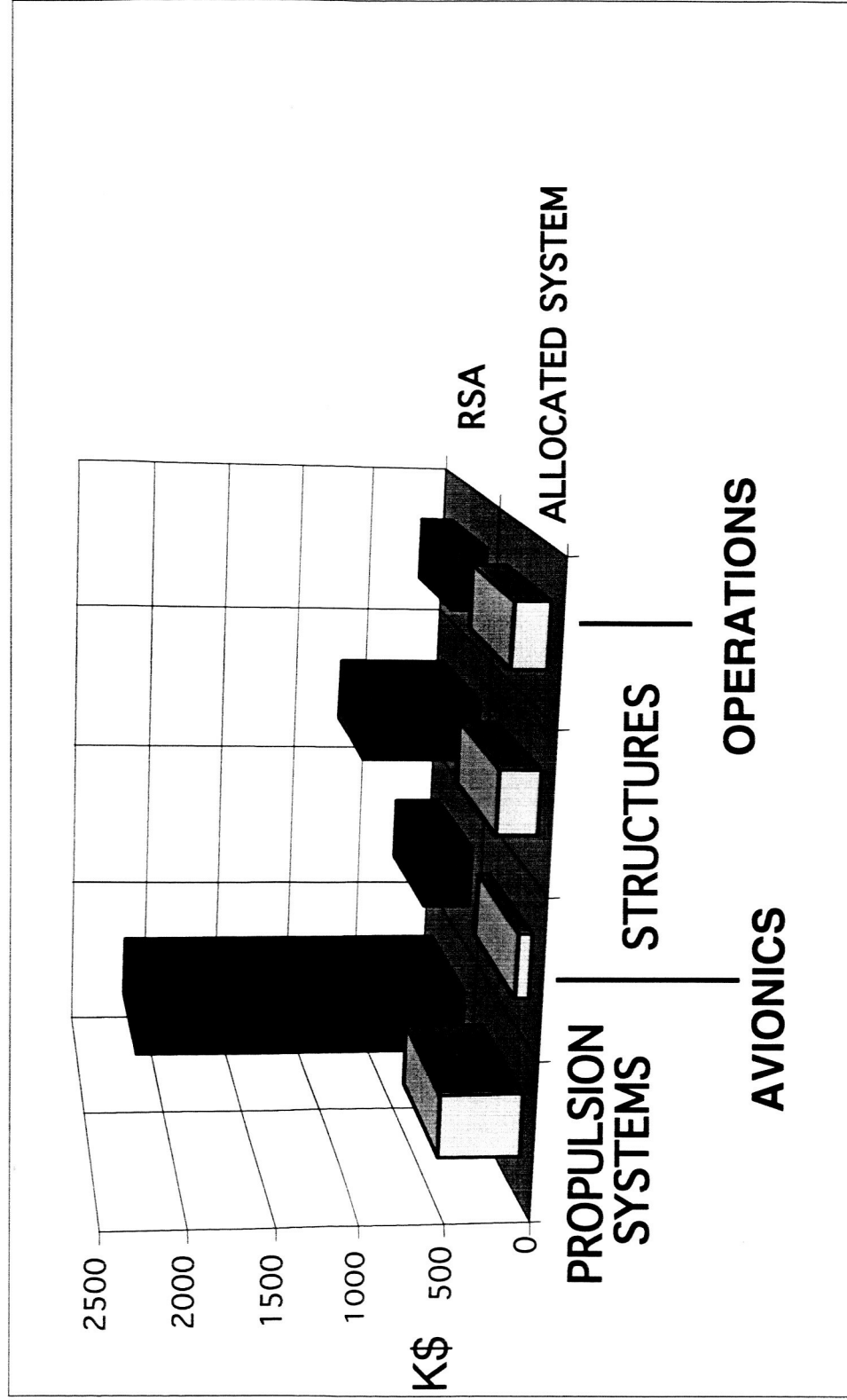
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Design to Cost Goals Not Achievable



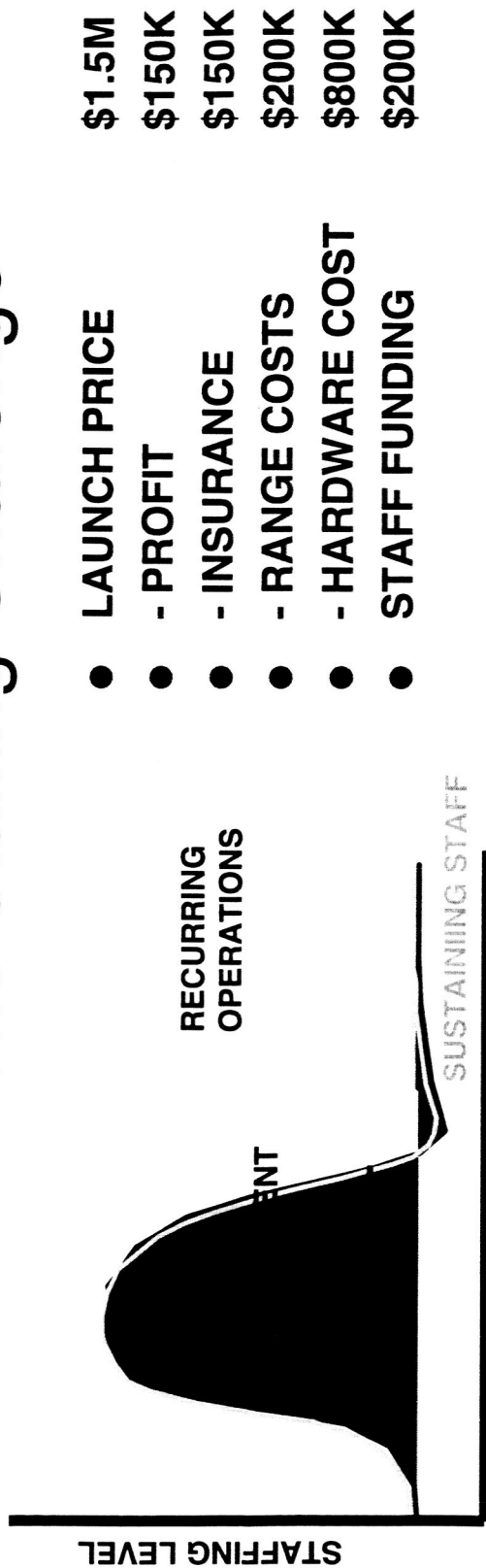
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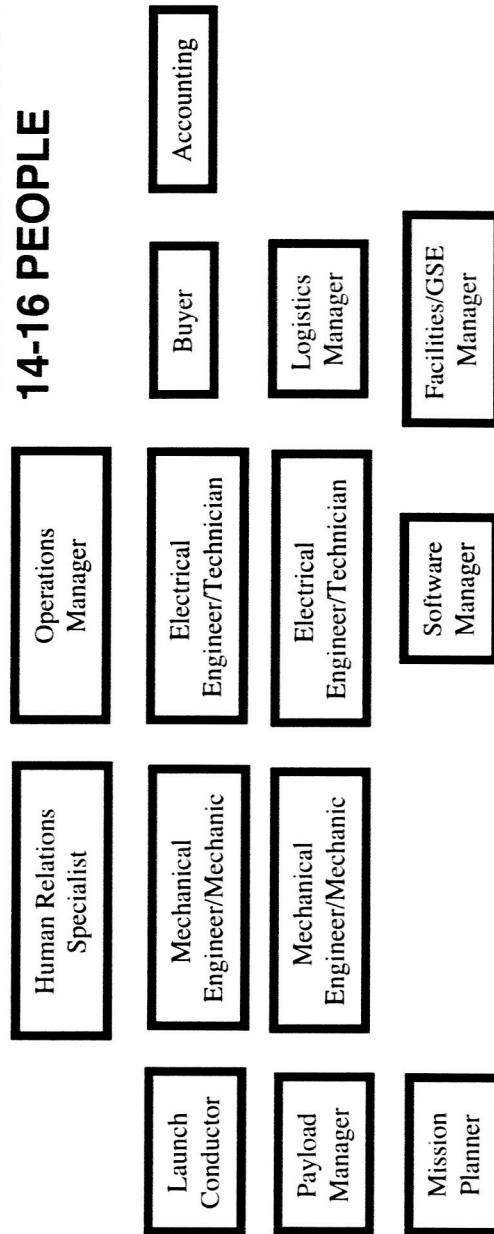


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The Staffing Challenge



- @ 10 LAUNCHES/YEAR--
SUSTAINING STAFF LIMITED TO
14-16 PEOPLE



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Low Operating Cost Not Achievable

- NASA Reference System Architecture Study Results

- Design to cost goals not achievable
- Staffing plan not viable @\$1.5M cost with low flight rate
- Estimated operating cost for two stage expendable system-\$3.5M to \$4M

- Industry Team Phase 1 Study Results

- Estimated operating cost for two stage expendable system-\$4.5M to \$6.5M

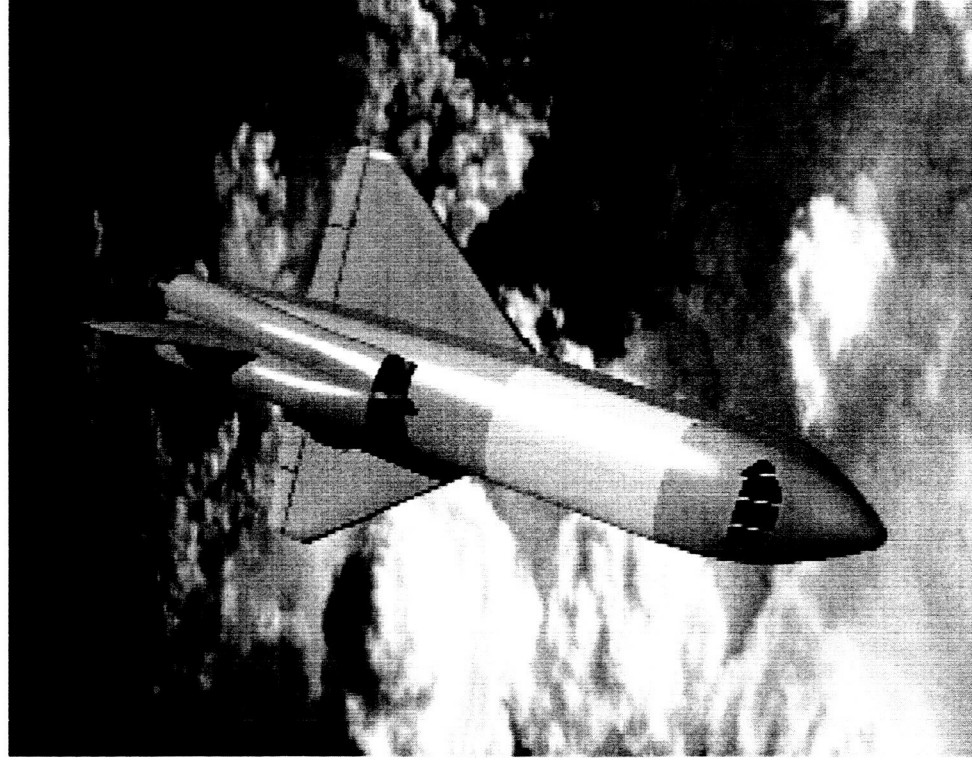
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RLV Technology Demonstration



- Development costs for Pioneer Rocketplane exceeded project resources
- RLV Flight demonstration not possible with Bantam industry partners

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Bantam in Summary

KEY PROGRAM TENETS	BANTAM
Focus on Small Payloads 150 to 300kg	NO SUSTAINABLE MARKET
Commercially Viable Launch Service 7% ROI	NO RETURN ON INVESTMENT
Low Recurring Cost \$1.5M to \$3M	UNACHIEVABLE RECURRING COST
Contribute to RLV Flight Demonstrations	RLV FLIGHT DEMONSTRATION NOT POSSIBLE
	Program was terminated and funds used to accomplish RLV component and subsystem technology development

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DRAFT DARPA Project Assessment

Based on Bantam Experience

KEY PROGRAM TENETS	BANTAM	RASCAL	FALCON
Focus on Small Payloads	NO SUSTAINABLE MARKET 150 to 300 kg	??? 50 to 100kg	Sustainable Market "Scout" Business Model 450 kg
Commercially Viable Launch Service	NO RETURN ON INVESTMENT	NA	NA
Low Recurring Cost	UNACHIEVABLE \$1.5M RECURRING COST	Difficult \$500K	Achievable \$5M
Contribute to RLV Flight Demonstrations	RLV FLIGHT DEMOSTRATION NOT POSSIBLE Program was terminated	Reusable first stage ??? Unlikely	CAV and HCV Good chance of Success